# Constructing Data Albums for Significant Severe Weather Events

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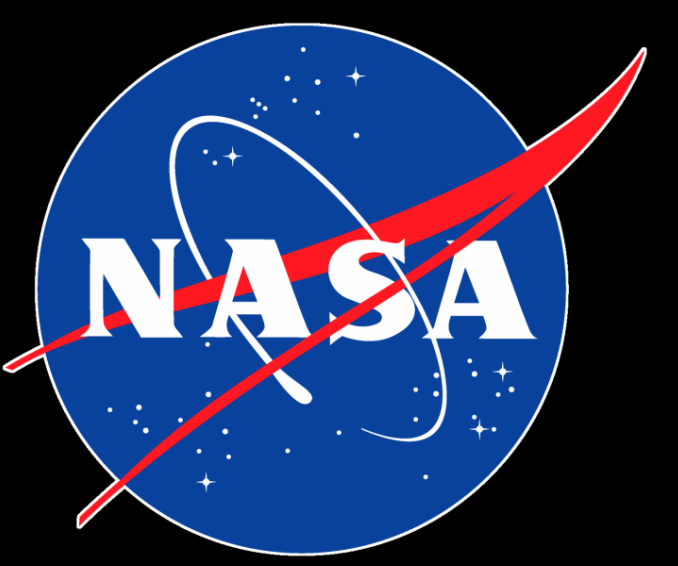
Why Do We Need Data Albums?

❑ Important for generating case studies to enable researchers to improve prediction of convective thunderstorms that may result in damaging wind, hail, lightning, flooding and tornadoes.

❑ "One-stop shop" for information and data related to a specific science topic or event, such as severe weather events

❑ Links relevant data files from different instruments, online searches, news reports, official storm summaries, pictures, background information, damages, deaths, and injuries

❑ Aggregated data are organized in ways that can aid in the discovery of new trends through exploration

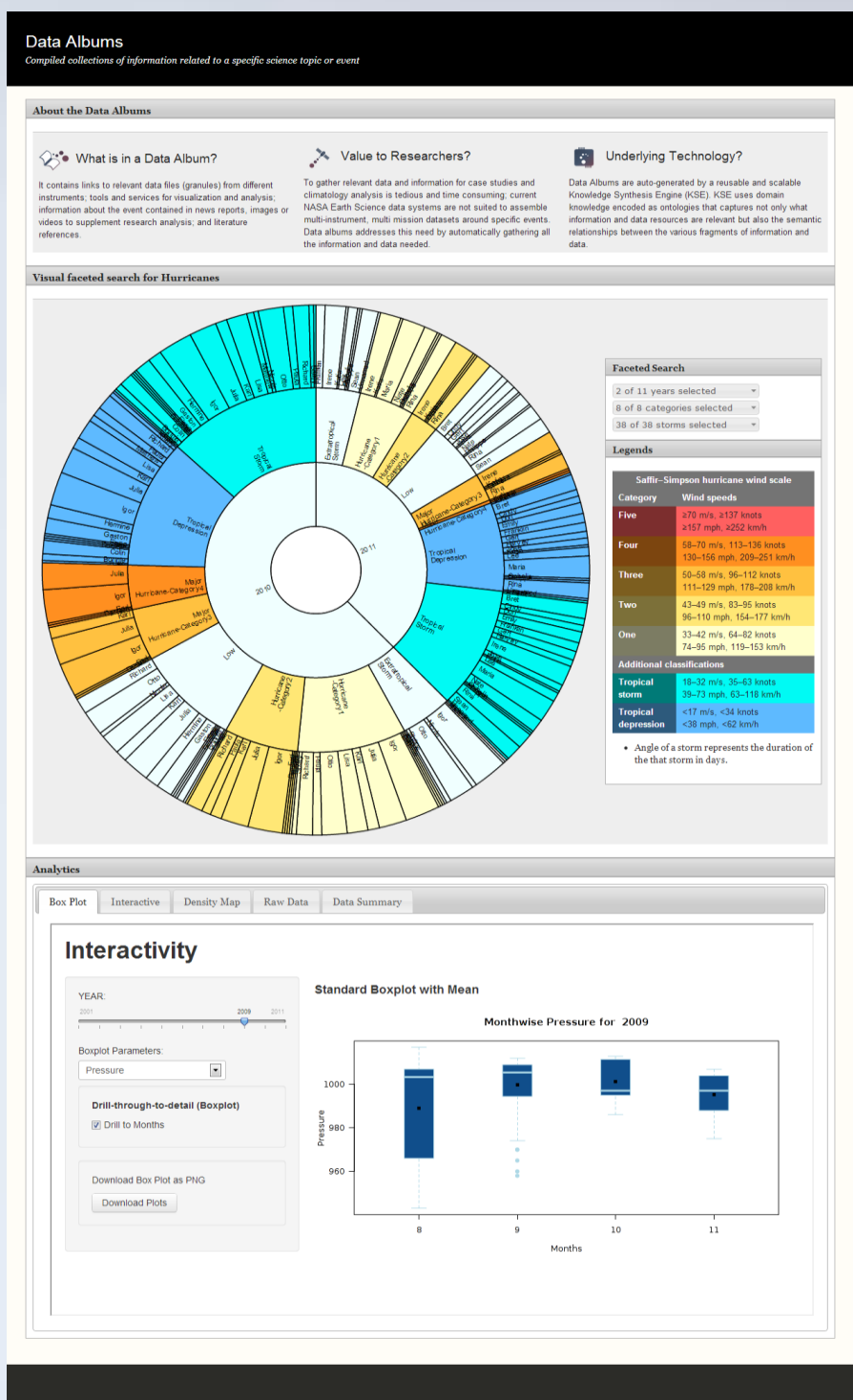❑ Existing hurricane Data Album (Figs. 1 & 2) modified for severe weather

Figure 1: Navigation system and charting capabilities of an ontology driven data album for hurricane case studies.
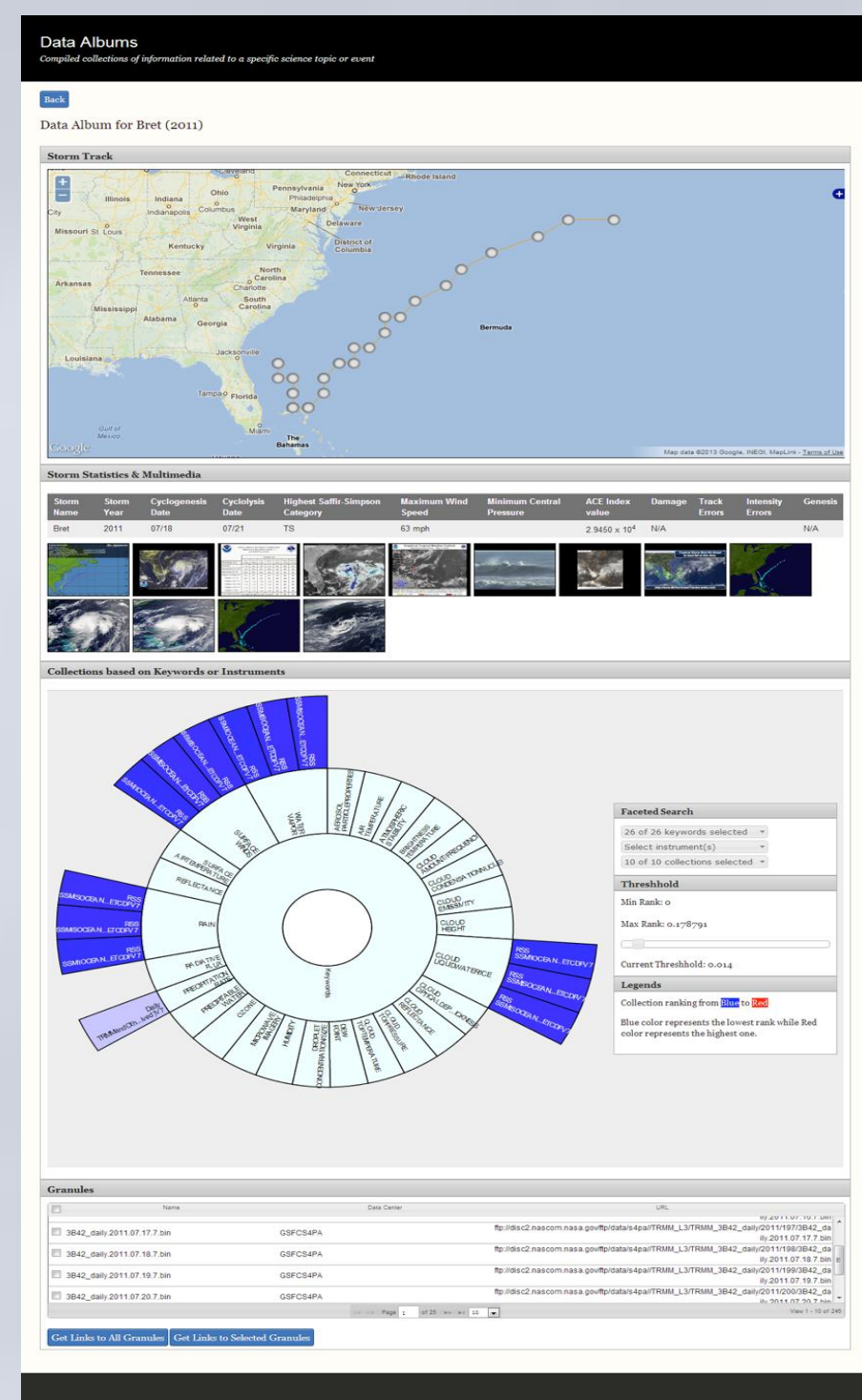

Figure 2: Full screen capture of the data album for Tropical Storm Brett showing the relevant NASA datasets in a pinwheel

Noesis 2.0

❑ Open source, reusable aggregation software, which incorporates a variety of current web aggregation concepts to pull together data from:
  ▪ Relevant NASA datasets are introduced through the Earth Observing System (EOS) Clearinghouse (ECHO; "2" in Fig. 3)
  ▪ Web-based information from various online data formats, such as PDF and HTML ("3" in Fig. 3)
  ▪ Social media information such as Twitter, Flickr, YouTube, etc. ("4" in Fig. 3)

Figure 3. Schematic of Noesis System used to create data albums

Ontology Development

❑ An ontology is a structured model of a specific topic showing key concepts and the relationships between them (Fig. 4)

❑ Can be thought of as similar to organizing the animal kingdom by phylum, species, etc.; however, instead using severe weather event keywords organized in the hierarchy
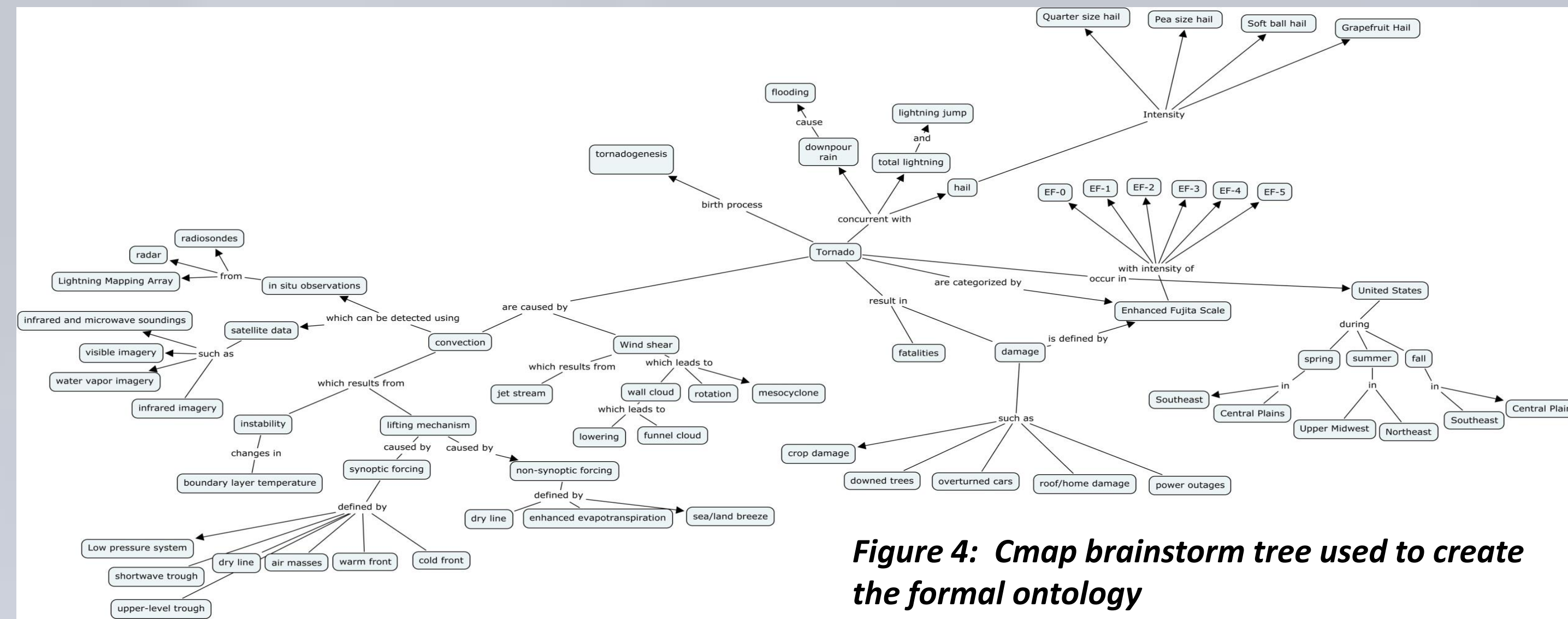

Figure 4: Cmap brainstorm tree used to create the formal ontology

Meteorological Datasets

❑ Meteorological products are used to refine search areas for NASA datasets and to determine the quality of pre-event forecasts

❑ Products brought in include Public Severe Weather Outlook (PWO), Convective Outlooks, Convective Weather Watches, Mesoscale Discussions, and Storm Reports disseminated by the Storm Prediction Center (see Fig. 5)

Social Media Archive

❑ Massive source of online data through news outlets and social media for investigating severe weather events

❑ YouTube Videos, Facebook, national and local news feeds online and recorded news broadcasts, Twitter, Flickr

NASA Datasets

❑ NASA collects many different Earth Science observations both from satellite and field campaigns for ground validation, which are stored in a clearinghouse called ECHO

❑ Only a small percentage of the datasets are relevant to meteorology and the measurement of severe weather phenomena

❑ Appropriate NASA datasets were selected based on their relevance to the severe weather phenomena for inclusion in a severe weather Data Album (Tables 1 & 2)

❑ Using the ontology and geolocation information in the SPC products; only the relevant NASA data are included in the Data Album

Table 1: Recent NASA field campaigns relevant to severe weather

Campaign	Location	Date	Relevance
Light Precipitation Validation Experiment (LPVEx)	Finland	Sept.- Dec. 2010	High latitude precipitation
Mid-latitude Continental Convective Clouds Experiment (MC3E)	Oklahoma	April- May 2011	Convective precipitation
Iowa Flood Study (IFloodS)	Iowa	May-Jun. 2013	Heavy precipitation

Table 2: NASA satellite data relevant to severe weather

Instrument	Relevant Measurement
AMSU-A	T, RH profiles
AIRS	T, RH profiles
AMSR-E	Precipitation, WV
TRMM	Rain Rate
LIS	Total Lightning
MLS Aura	T, RH, cloud ice
OLS	Moonlit clouds
VIIRS	Clouds
CrIS	T, RH profiles

Severe Weather Data Album

❑ Home page (Fig. 5 left):
  ▪ Statistical overview of weather events binned by date
  ▪ By clicking on the year, month, and day, users can "dig down" to investigate severe weather events from a particular date

❑ Event page (Fig. 5 right):
  ▪ Aids in answering the question: "Was this a good forecast?" by providing forecast products and NASA datasets
  ▪ Interactive map with storm reports overlaying convective outlooks detailing the forecast process leading up to an event
  ▪ Videos, pictures, and social media information during and after the event
  ▪ Based on date and location of convective outlook, all NASA data relevant to severe storms is linked into the page
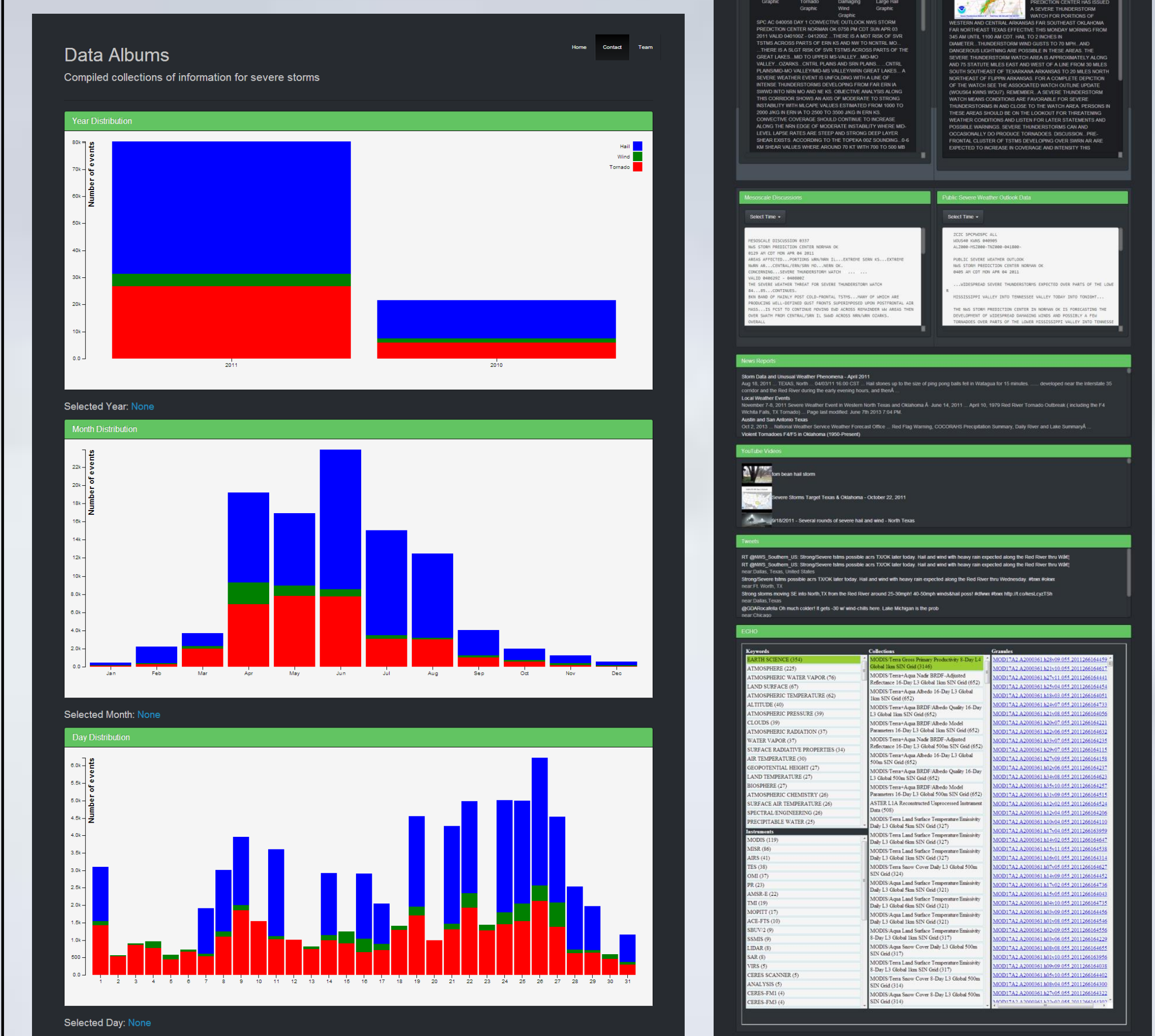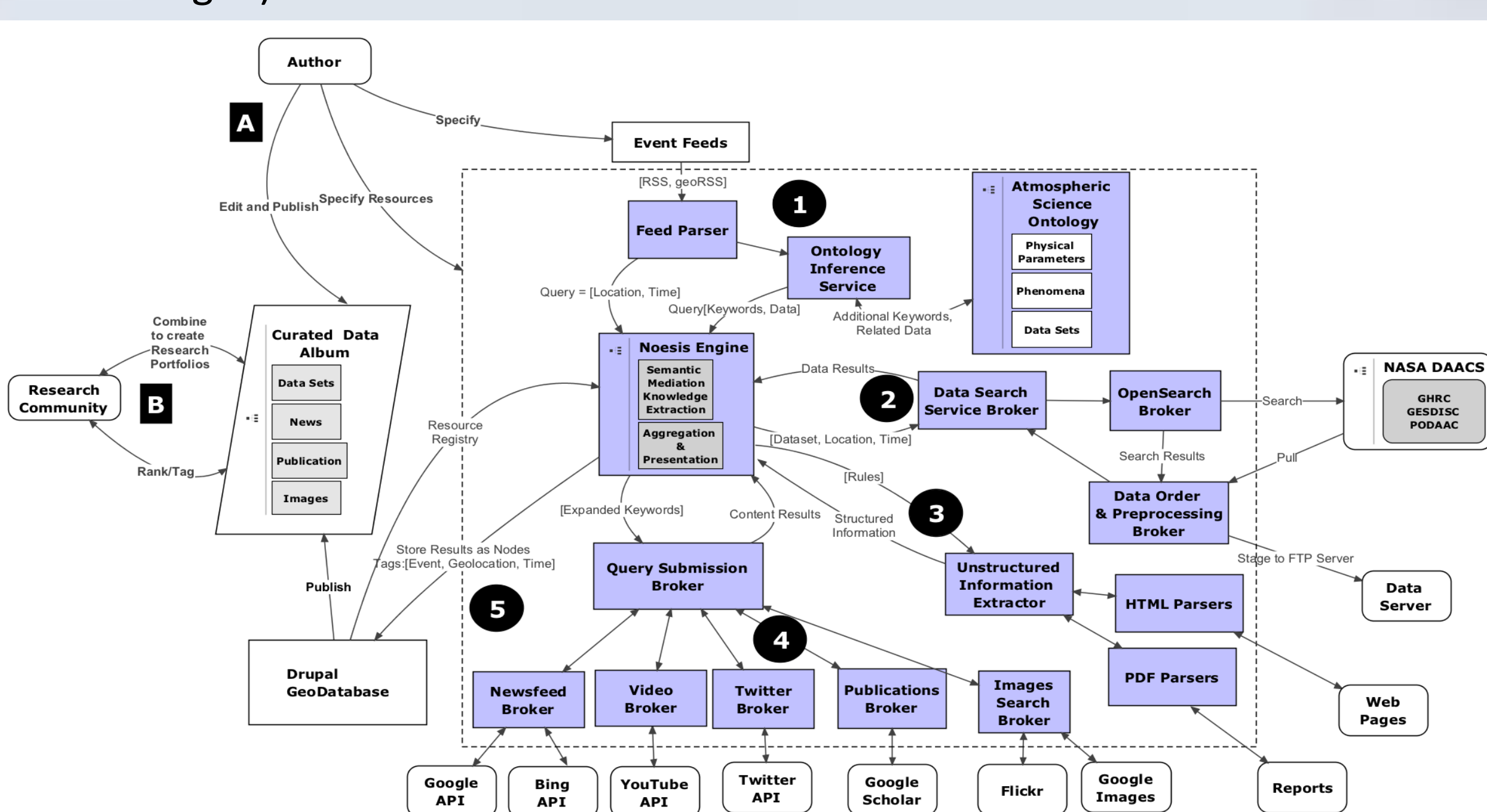

Figure 5: Home page (left) and event page (right) for a widespread severe weather event on 3-4 April 2011.

Summary

❑ Data Albums provide a one-stop-shop combining datasets from NASA, NWS, online new sources, and social media

❑ Data Albums will help meteorologists better understand severe weather events to improve predictive models

❑ Developed a new ontology for severe weather based off current hurricane Data Album

❑ Selected relevant NASA datasets for inclusion in Data Album

Acknowledgements